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B8M
Selected US specifications from IPC sub-class B65H

(54) Magnetic tape cassette with tape reel assembly having floating reel hub

(57) A magnetic tape cassette comprises a cassette casing 3 housing a pair of tape reel assemblies 5, around which a magnetic tape 4 is wound. Each tape reel assembly comprises a reel hub 13 and a center core 14. The central core is free to move independently of the reel hub in a direction parallel to the rotational axis of the tape reel assembly, allowing axial movement of the central core for engagement with a reel shaft during thrust-loading. The reel hub is, however, associated with the central core for rotation therewith when the central core is driven.

FIG. 1

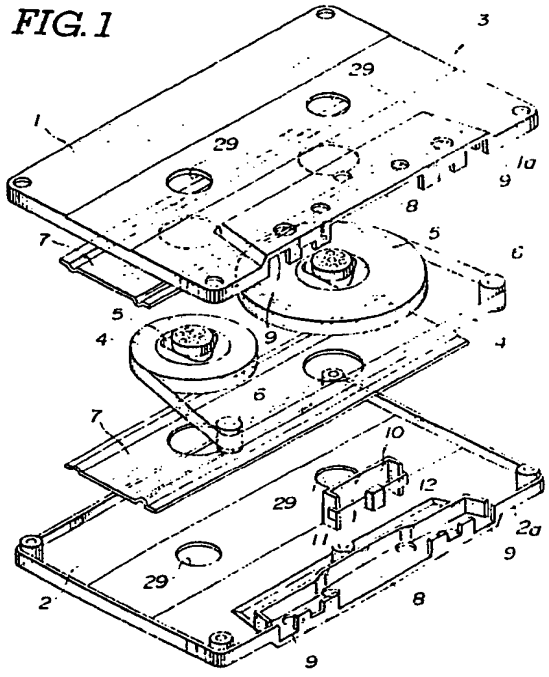

FIG. 2

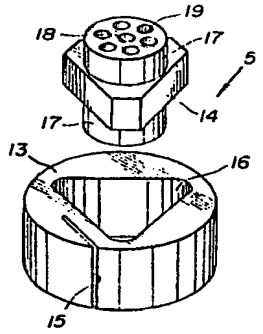

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FIG. 1

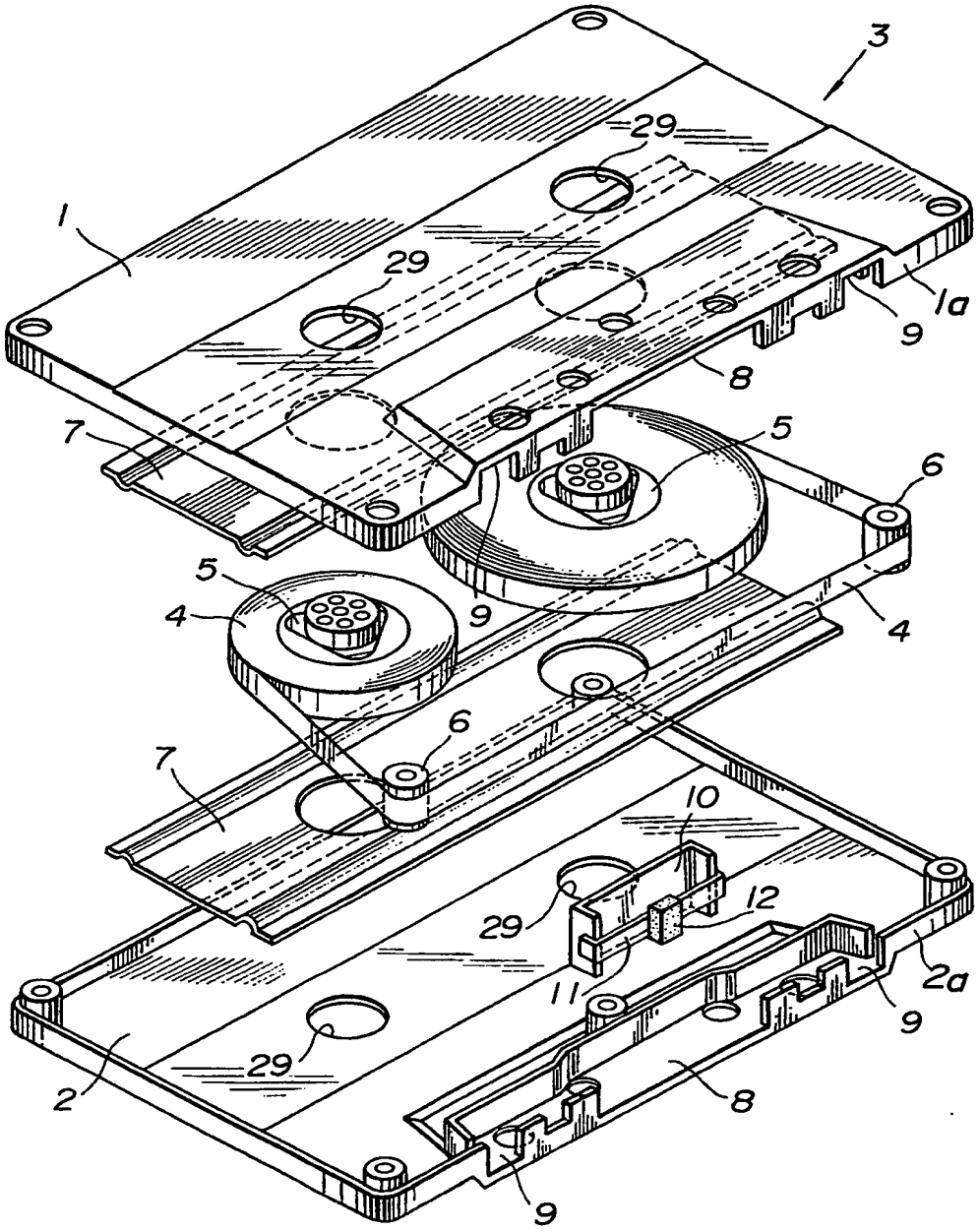

FIG.2

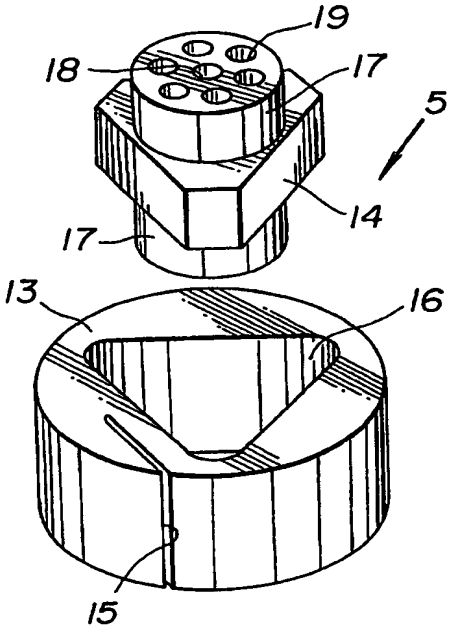

FIG.3

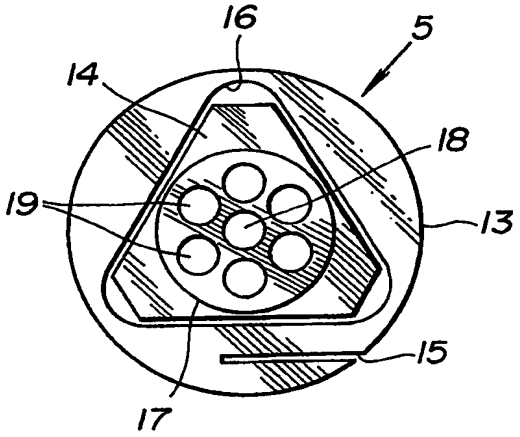

FIG.4

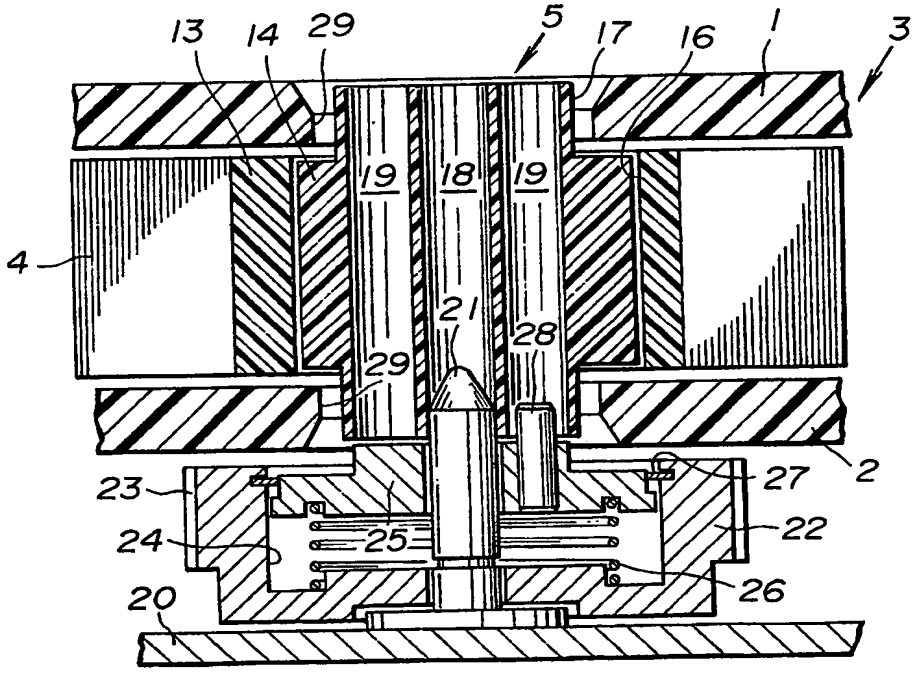

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FIG.5

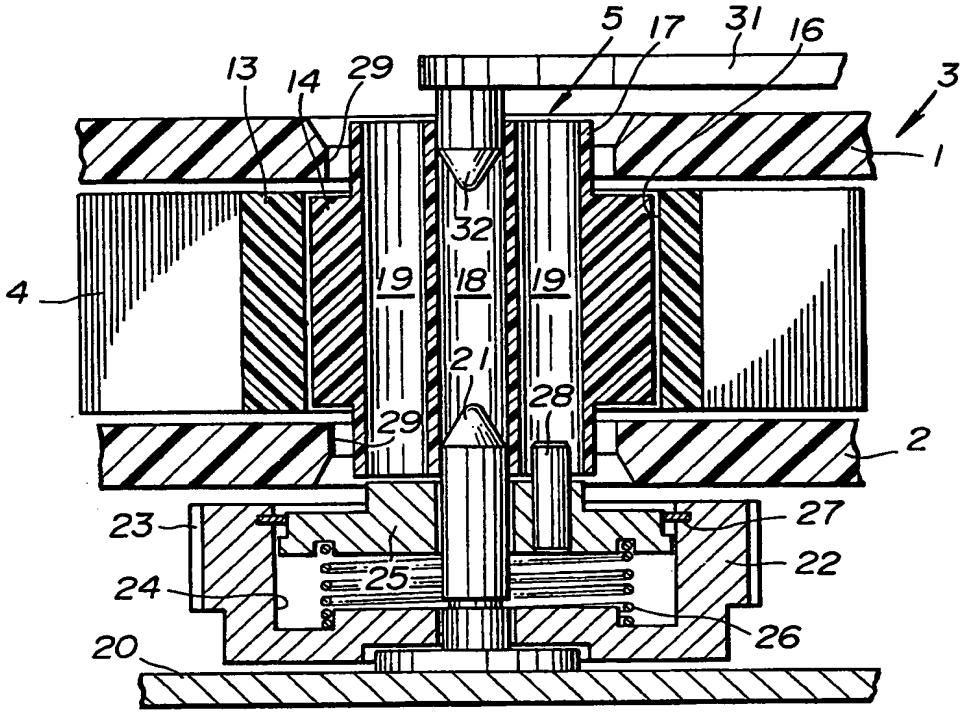
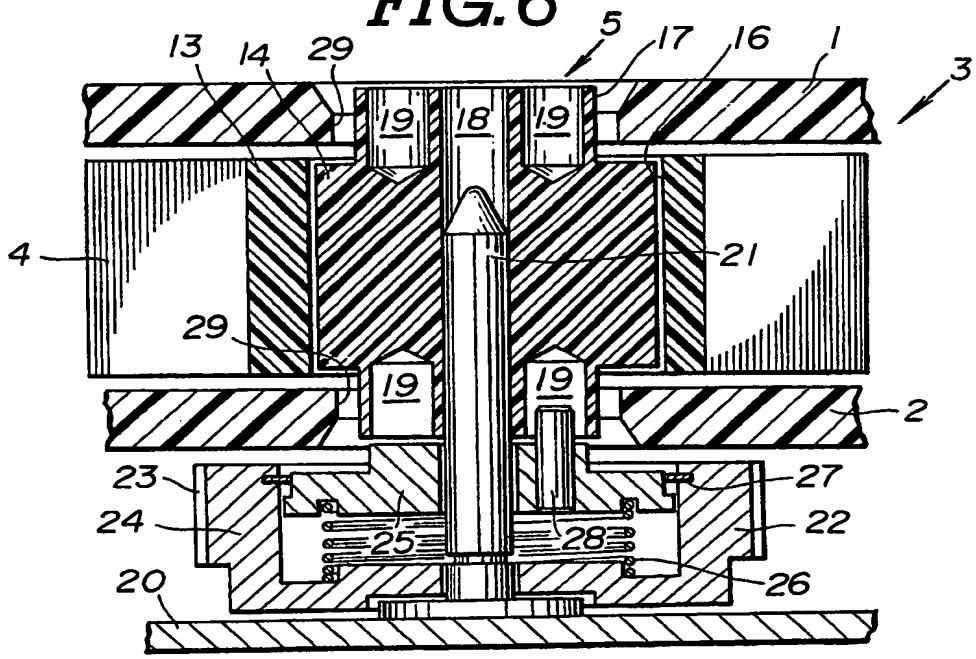


FIG.6



SPECIFICATION

Magnetic tape cassette with tape reel assembly having floating reel hub

The present invention relates generally to a magnetic tape cassette particularly adapted for thrust-loading. More specifically, the invention relates to a magnetic tape cassette having tape reel assemblies with reel hubs which float axially and cooperate with a center core of the assembly for rotation therewith.

In general, a magnetic tape cassette has a pair of tape reel assemblies with central through openings for receiving a reel shaft of a recording and reproducing apparatus, such as tape player unit. The through openings in the tape reel assemblies have radially extending recesses. The reel shafts have a plurality of radial extensions of which conform to the grooves recessed in the through openings. Engagement between the extensions and the grooves ensures corotation of the tape reels and the reel shaft for recording and reproducing of the data.

In the magnetic tape cassette constructed as set forth above, the magnetic tape tends to be stressed upon loading through a tape reel. Such stress is apted to damage the magnetic tape and to attect performance and/or quality of recordin and reproduction.

In addition, in such typical magnetic tape cassettes, it is necessary to insert the reel shaft into the through opening deep enough to establish engagement between the extensions and the grooves. Conventionally, in order to obtain satisfactory engagement between the extensions and grooves, it has been necessary to insert the reel shaft to a depth of at least half of the overall axial length of the through openings. This type of tape cassette cannot be loaded in a player unit with a thrust-loading tape-loading mechanism. In thrust-loading, the reel shaft is inserted into the openings or hole to a relatively shallow extent. On the other hand, thrust-loading of tape cassettes is known to be advantageous in that it requires less vertical clearance for loading the tape.

In order to form a more compact, in particular a thinner tape player unit, it is thus desirable to employ a thrust-loading system. Thus, a magnetic tape cassette suitable for thrust-loading is required.

Therefore, it is a principle object of the invention to provide a magnetic tape cassette which can hold the magnetic tape free from a stress upon loading.

Another object of the invention is to provide a magnetic tape cassette having a tape reel assembly with a reel hub supported in an axially-floating condition and which can be driven by a reel shaft of the tape player.

In order to accomplish the above-mentioned and other objects, a magnetic tape cassette, according to the invention, comprises a cassette casing housing a pair of tape reel assemblies, around which a magnetic tape is wound. Each tape reel assembly comprises a reel hub and a center core. The reel hub is associated with the central core so as to be free to move independently of the central core in a direction parallel to the rotational axis of the tape reel assembly. This allows axial movement of the central core for engagement with a reel shaft during thrust-loading. The reel hub is, in turn, associated with the central core for rotation therewith when the central core is driven by the reel shaft to drive the tape.

By allowing the tape reel assembly with the reel hub to float axially relative to the central shaft, axial movement of the central core ensures that the reel hub will not apply stress of the tape during loading.

In addition, according to a specific embodiments, the magnetic tape cassette can be adapted for thrust-loading for enabling the tape player unit as recording and reproducing apparatus to reduce the vertical size. Floating of the reel hub relative to the center shaft so that the center shaft can axially move independently of the reel hub allows the magnetic tape cassette for loading to a tape player of the thrust-loading type.

According to one aspect of the invention, a magnetic tape cassette comprises a cassette casing having upper and lower horizontal walls formed with openings, and at least one tape reels disposed within the cassette casing and wound therearound a magnetic tape, the tape reel having a reel hub hasing a periphery, on which the magnetic tape is wound, and a central polygon hole extending along the center axis thereof, a center core of polygon form comforming the polygon hole of the reel hub to be received within the polygon hole in axially movable fashion, and a cylindrical extension extending vertically from the center core and having upper and lower end extending into the openings of upper and lower horizontal walls of the cassette casing, the cylindrical extension defines anaxially extending centeral hole for receiving a spindle of a tape player unit therein and a plurality of excentrically arranged viods extending in parallel relationship to the central hole for receiving a drive pin in a tape drive mechanism of the tape player.

The reel hub has a tape end clamp for clamping the end of the magnetic tape. The polygon hole formed in the center core is of generally triangular shape in plan view and the center core is formed into generally triangular shape in plan view.

According to another aspect of the invention, a magnetic tape cassette comprises a cassette casing housing therein a magnetic tape, a tape reel disposed within the cassette casing and wound therearound the magnetic tape, the tape reel including a reel hub with a cylindrical outer periphery on which the magnetic tape is wound, and a rotary shaft adapted to rotatingly driven by a tape drive mechanism of a recording and reproducing apparatus, the rotary shaft being cooperated with the reel hub for rotation therewith and axially movable independently of siad reel hub.

The reel hub defines an axially extending hole through which the rotary shaft extends, the rotary shaft being disposed within the axially extending hole of the reel hub for axial movement independently of the reel hub. The magnetic tape cassette

further comprises means for cooperating the rotary shaft with the reel hub for rotation therewith. The cooperating means comprises an extension extending from the outer periphery of the rotary shaft transversely to the rotation axis of the rotary shaft, the extension having a planer section, and the axially extending hole having a planer section formed in the inner periphery thereof, the planer section of the axially extending hole being adapted to mate with the planer section of the extension for restricting relative angular displacement of the reel hub relative to the rotary shaft.

The rotary shaft defines an axially extending center opening and a plurarity of void extending in parallel to the the center opening and arranged at raidally offset position relative to the rotation axis of the rotary shaft, the center opening being adapted to receive a spindle of the tape drive mechanism of the recording and reproducing apparatus and the void being adapted to receive a drive pin of the tape drive mechanism and arranged in a position offset from the center axis of the sprindle. The spindle of the tape drive mechanism is adpated to enter the center opening of the rotary shaft at a length substantioally less than half of the overall axial length of the center opening.

According to a further aspect of the invention, a combination of a magnetic tape cassette and a tape player adapted to play the magnetic tape cassette, comprises a tape drive mechanism for driving a magnetic tape for recording and reproducing, having a center spindle and at least one drive pin arranged adjacent the spindle and radially offset from the center axis of the spindle for revolution about the center axis, and the magnetic tape cassette having a cassette casing housing therein a magnetic tape, a tape reel disposed within the cassette casing and wound therearound the magnetic tape, the tape reel including a reel hub with a cylindrical outer periphery on which the magnetic tape is wound, the rotary shaft being cooperated with the reel hub for rotation therewith and axially movable independently of siad reel hub, the rotary shaft defines an axially extending center opening and a plurarity of void extending in parallel to the the center opening and arranged at raidally offset position relative to the rotation axis of the rotary shaft, the center opening being adapted to receive the spindle of the tape drive mechanism of the recording and reproducing apparatus and the void being adapted to receive the drive pin of the tape drive mechanism and arranged in a position offset from the center axis of the sprindle.

The present invention will be understood more fully from the detailed description given herebelow and from the accompanying drawings of the preferred embodiment of the invention, which, however, should not be taken to limit the invention to the specific embodiment, but are for explanation and understanding only.

In the drawings:

Figure 1 is an exploded perspective view of the preferred embodiment of a magnetic tape cassette according to the present invention;

Figure 2 is an enlarged exploded view of a tape reel of the preferred embodiment of the magnetic tape cassette of Figure 1;

Figure 3 is an enlarged plan view of the tape reel of Figure 2, which shows the tape reel in the assembled position;

Figure 4 is a section through a tape drive mechanism suitable for driving the preferred embodiment of the magnetic tape cassette of Figure 1;

Figure 5 is a section through another tape drive mechanism suitable for driving the preferred embodiment of the magnetic tape cassette of Figure 1; and

Figure 6 is a section through a further different tape drive mechanism suitable for driving a modified, magnetic tape cassette.

Referring now to the drawings, particularly to Figure 1, the preferred embodiment of a magnetic tape cassette has a cassette casing 3 which comprises an upper half 1 and a lower half 2. Both of the upper and lower halves 1 and 2 are made of synthetic resin and combine to form the cassette casing 3.

It should be noted that the preferred embodiment is designed to form a magnetic tape cassette smaller than the well-known, so-called micro-cassette. In this case, the cassette casing 3, fully assembled may be approximately 33 mm wide, approximately 26 mm long and approximately 6 mm thick, for example.

A pair of tape reels 5 are housed in the cassette casing 3. A magnetic tape serving as a recording medium is wound around the tape reels 5 and stretched therebetween by means of tape guides 6. Upper and lower bearing sheets 7, which are made of a thin resin film, are disposed between the upper and lower edge of the tape reels 5 and the opposing surfaces of the upper and lower halves 1 and 2.

The cassette casing 3 has a vertically extending front end wall made up of the front end wall 1a of the upper half 1 and the front end wall 2a of the lower half 2. The lower and upper edges of the front end walls 1a and 2a mates. The front end walls 1a and 2a have cut-outs 8 forming a head-receiving opening through which a magnetic head of a tape player is inserted into the tape cassette 3. The head-receiving opening 8 is essentially centered in the front wall of the tape cassette 3. The front end walls 1a and 2a also have cut-outs 9 at either transverse end. The cut-outs 9 form pinch-roller receiving openings, through which pinch rollers of the tape player are inserted. Opposing the head receiving opening 8, a shield plate 10 with a tape pad 12 mounted on the shield plate by means of a leaf spring 11, is disposed within the cassette casing 3. The tape pad 12 serves to hold the magnetic tape 4 against the magnetic head once inserted into the head-receiving opening 8.

Figures 2 and 3 show the tape reel 5 in greater detail. The tape reel 5 comprises a hub 13 of generally cylindrical form and a center core 14 extending through the hub. The hub 13 has a vertical periphery about which the magnetic tape 4 is wound. A non-radial slit 15 extending inward from the outer periphery of the hub 13 retains one end

of the tape 4. In practice, the end of the magnetic tape 4 is fixedly attached to the inner periphery of the slit 15 by way of heat-sealing, bonding or the like.

The hub 13 has a generally triangular opening 16 accommodating the center core 14. The center core 14 is generally triangular, conforming to the triangular opening 16 in the hub 13. Cylindrical extensions 17 project from the upper and lower surfaces of the center core 14. The upper end of the upward cylindrical extension 17 is received in a circular opening 29 formed in the upper half 1. Similarly, the lower end of the downward cylindrical extension 17 is received in a circular opening 29 formed in the lower half 2.

A center opening 18 extends axially through the cylindrical extensions 17 and the center core 14 and opens onto the upper and lower ends of the upward and downward extensions 17. A plurality of, e.g. 6, axial through openings 19 through the cylindrical extensions 17 and the center core 14 surround the center opening 18. The openings 19 also open onto the upper face of the upward cylindrical extension 17 and the lower face of the downward cylindrical extension 17.

Figure 4 shows the magnetic tape cassette, constructed as above, inserted in a tape player. The tape player has a chassis 20 and a center spindle 21 extending upwards from the chassis. A reel base 22 coaxial with the center spindle 21 rotates therewith. The reel base 22 has a gear section 23 engageable to a power train (not shown) of the driving mechanism to receive a driving force. The reel base 22 has a recess 24 housing a drive disc 25. The drive disc 25 is biased upwardly by means of a bias spring 26. A stopper ring 27 projecting inward into the recess 24 limits the upward travel of the drive disc. A drive pin 28 projects upwards from the upper surface of the drive disc. The drive pin 28 is offset from the axis of rotation of the drive mechanism. The magnitude of the offset of the drive pin 28 matches the offset of the openings 19 from the axis of the center opening 18.

The drive disc 25 cooperates with the reel base for rotation therewith. On the other hand, the drive disc 25 is free to move axially independently of the reel base 22. Similarly, since the periphery of the center core 14 conforms to the inner periphery of the triangular opening 16 of the hub 13, the center core 14 and the hub 13 rotate together. At the same time, the center core 14 remains free to move axially independently of the hub 13.

As apparent from Figure 4, the center spindle 21 of the tape player is substantially shorter than the conventional center spindle. Therefore, the center spindle 21 projects a substantially shorter distance into the center opening 18 of the center core 14 than in conventional system. The drive pin 28 of the drive disc 25 engages one of the openings 19 in the center core 14 to transmit rotational driving force from the reel base 22 to the center core 14. Therefore, the center core 14 is driven to rotate together with the reel base 22 and the drive disc 25. Since the center core 14 cooperates with the hub 13 for rotation therewith, the hub 13 is also driven to rotate with the reel base 22. The magnetic tape 4 wound around the hub 13 is thus driven by rotation of the reel base 22 to run through the head-receiving opening around the tape guides 6. Thus, on loading, the tape is loaded onto the magnetic head (not shown) of the tape player projecting through the head-receiving opening for recording and reproduction.

In the shown embodiment, since the center spindle 21 and the drive pin 28 project a relatively short distance into the center opening 18 and the openings 19 of the center core, thrust-loading of the tape cassette is possible. This substantially lowers the required vertical movement of the tape reel 3 relative to the reel base 22 and so reduces the required minimum height of the tape player overall.

Furthermore, since the center core 14 is axially movable independently of the hub 13, stress exerted on the center core 14, which is a natural consequence of loading the tape cassette into the tape player, is not transmitted to the hub 13 and the tape. Such stress tends to be exerted vertically when the tape cassette 1 is inserted into the tape player. Also, even if the center core should lie oblique to the rotation axis, the driving force can be accurately transmitted by the center core 14 to the reel hub 13.

Various modifications to the tape cassette and the tape player of the aforementioned embodiment are possible without negating the novel advantages of the invention. Some examples of such modifications are described herebelow with reference to Figures 5 and 6. In the discussion below, the elements corresponding to the foregoing embodiment will be referred to by the same reference numerals.

In Figure 5, a tape player is provided with an auxiliary spindle 32 in addition to the center spindle 21. The auxiliary spindle 32 is mounted on a resilient support 31 and aligned with the center spindle. The auxiliary spindle 32 is designed to engage the upper end of the center opening 18 of the center core 14. This auxiliary spindle 32 cooperates with the center spindle 21 to hold the center core 14 vertical and preventing displacement of the center core relative to the rotation axis.

Figure 6 shows another modification, in which the openings 19 of the foregoing embodiment are replaced with blind holes 19'. These holes 19 are deep enough to accommodate the drive pin 28. In this modification, the center spindle 21 is longer than in foregoing embodiments, so that it extends over half-way through the center opening 18. Therefore, this modified structure is not suitable for thrust-loading but is designed for normal elevating-loading systems or cassette holder systems. With this arrangement, inclination of the center core relative to the rotation axis can be successfully prevented. At the same time, with this embodiment, any stress that may be exerted on the tape reel would be absorbed by the axially floating engagement between the center core 14 and the reel hub 13.

While some specific modifications to the pre-

ferred embodiment have been described hereabove, the invention can be embodied in various ways not illustrated hereabove. Therefore, the invention should be understood to include all possible embodiments and modifications to the shown embodiments which do not depart from the principles of the invention as set out in the appended claims.

CLAIMS

1. A magnetic tape cassette comprising:
a cassette casing having upper and lower horizontal walls formed with openings; and
at least one tape reels disposed within said cassette casing and wound therearound a magnetic tape, said tape reel having
a reel hub hasing a periphery, on which said magnetic tape is wound, and a central polygon hole extending along the center axis thereof;
a center core of polygon form comforming said polygon hole of said reel hub to be received within said polygon hole in axially movable fashion; and
a cylindrical extension extending vertically from said center core and having upper and lower end extending into said openings of upper and lower horizontal walls of said cassette casing, said cylindrical extension defines anaxially extending centeral hole for receiving a spindle of a tape player unit therein and a plurality of excentrically arranged viods extending in parallel relationship to the central hole for receiving a drive pin in a tape drive mechanism of said tape player.

2. The magnetic tape cassette as set forth in claim 1, wherein said reel hub has a tape end clamp for clamping the end of said magnetic tape.

3. The magnetic tape cassette as set forth in claim 1, wherein said polygon hole formed in said center core is of generally triangular shape in plan view and said center core is formed into generally triangular shape in plan view.

4. A magnetic tape cassette comprising:
a cassette casing housing therein a magnetic tape;
a tape reel disposed within said cassette casing and wound therearound said magnetic tape, said tape reel including:
a reel hub with a cylindrical outer periphery on which said magnetic tape is wound; and
a rotary shaft adapted to rotatingly driven by a tape drive mechanism of a recording and reproducing apparatus, said rotary shaft being cooperated with said reel hub for rotation therewith and axially movable independently of siad reel hub.

5. The magnetic tape cassette as set forth in claim 4, wherein said reel hub defining an axially extending hole through which said rotary shaft extends, said rotary shaft being disposed within said axially extending hole of said reel hub for axial movement independently of said reel hub.

6. The magnetic tape cassette as set forth in claim 5, which further comprises means for cooperating said rotary shaft with said reel hub for rotation therewith.

7. The magnetic tape cassette as set forth in claim 6, wherein said cooperating means comprises an extension extending from the outer periphery of said rotary shaft transversely to the rotation axis of the rotary shaft, said extension having a planer section, and said axially extending hole having a planer section formed in the inner periphery thereof, said planer section of said axially extending hole being adapted to mate with said planer section of said extension for restricting relative angular displacement of said reel hub relative to said rotary shaft.

8. The magnetic tape cassette as set forth in claim 7, wherein said rotary shaft defines an axially extending center opening and a plurarity of void extending in parallel to said said center opening and arranged at raidally offset position relative to said rotation axis of said rotary shaft, said center opening being adapted to receive a spindle of said tape drive mechanism of said recording and reproducing apparatus and said void being adapted to receive a drive pin of said tape drive mechanism and arranged in a position offset from the center axis of said sprindle.

9. The magnetic tape cassette as set forth in claim 8, wherein said spindle of said tape drive mechanism is adpated to enter said center opening of said rotary shaft at a length substantioally less than half of the overall axial length of said center opening.

10. A combination of a magnetic tape cassette and a tape player adapted to play said magnetic tape cassette, comprising:
a tape drive mechanism for driving a magnetic tape for recording and reproducing, having a center spindle and at least one drive pin arranged adjacent said spindle and radially offset from the center axis of said spindle for revolution about said center axis;
said magnetic tape cassette having
a cassette casing housing therein a magnetic tape;
a tape reel disposed within said cassette casing and wound therearound said magnetic tape, said tape reel including a reel hub with a cylindrical outer periphery on which said magnetic tape is wound, said rotary shaft being cooperated with said reel hub for rotation therewith and axially movable independently of siad reel hub, said rotary shaft defines an axially extending center opening and a plurarity of void extending in parallel to said said center opening and arranged ar raidally offset position relative to said rotation axis of said rotary shaft, said center opening being adapted to receive said spindle of said tape drive mechanism of said recording and reproducing apparatus and said void being adapted to receive said drive pin of said tape drive mechanism and arranged in a position offset from the center axis of said sprindle.

11. The combination as set forth in claim 10, wherein said reel hub defining an axially extending hole through which said rotary shaft extends, said rotary shaft being disposed within said axially extending hole of said reel hub for axial movement independently of said reel hub.

12. The combination as set forth in claim 11,

which further comprises means for cooperating said rotary shaft with said reel hub for rotation therewith.

13. The combination as set forth in claim 12, wherein said cooperating means comprises an extension extending from the outer periphery of said rotary shaft transversely to the rotation axis of the rotary shaft, said extension having a planer section, and said axially extending hole having a planer section formed in the inner periphery thereof, said planer section of said axially extending hole being adapted to mate with said planer section of said extension for restricting relative angular displacement of said reel hub relative to said rotary shaft.

14. The magnetic tape cassette as set forth in claim 13, wherein said spindle of said tape drive mechanism is adapted to enter said center opening of said rotary shaft at a length substantioally less than half of the overall axial length of said center opening.

15. A magnetic tape cassette constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying.

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